NOAA's UNDERSEA RESEARCH PROGRAM

Silver Spring, Maryland

Mission and Purpose

NOAA's Undersea Research Program (NURP) supports NOAA's mission by placing scientists underwater to research issues of regional, national, and global importance. We provide access to advanced underwater technologies and methods, including submersibles, sea floor observatories, mixed gas diving, and *Aquarius*, the world's only underwater laboratory. By using this *in situ* approach, NURP makes observations, collects samples, and conducts complex experiments.

We are a grant program with about 90 percent of our funding going to the extramural research community. NURP operates through six regional undersea research centers and an institute for technology development that provide operational support and funding for undersea research targeted at NOAA's management needs. Research quality is ensured by competitive and high standards of peer review patterned after that of the National Science Foundation. Projects are selected for support on the basis of scientific merit and relevance to NOAA needs. NURP's mission is to increase knowledge essential for the wise use of oceanic, coastal, and large lake resources through advanced undersea sampling, observation, experimentation and education. NURP conducts targeted strategic research directed at meeting the research needs of resource managers in support of, but not limited to, these NOAA programs:

a. *NOAA's Coral Program*. Conducts strategic research on overfishing, pollution, coral diseases and bleaching, invasive species, stressor impacts, management of Marine Protected Areas (MPA's); characterizing and understanding deep -sea coral communities.
b. *NOAA's Fisheries Management Program*. Conducts strategic research to identify, map, assess, and understand the role of essential fish habitat; identify damage to fisheries resources and habitat rates of recovery; improve stock assessments; understand life histories of commercial fish species; determine effectiveness of MPA's and marine zoning ; and stock and habitat enhancement effectiveness.
c. *NOAA's Ecosystem Research Program*. Conducts fundamental and applied research on future ocean resource management issues, including characterization and assessment of deep-sea communities at hydrothermal vents, cold seeps, and volcanoes; role of methane hydrate degassing ; studies of past climates; and isolating and culturing novel organisms to determine their commercial viability.

Brief History

NURP traces its origins to NOAA's involvement in undersea science in the early 1970's to support the Agency's scientific responsibilities. Based on a National Research Council study, NOAA re-directed an existing program to form NURP. By 1980, cooperative agreements were formalized with several universities to establish undersea research facilities and programs. NURP was soon supporting a undersea program involving a number of university based centers, managing and providing NOAA's share of support for the deep submersible ALVIN, and a program of research and development related to diver safety pursuant to section 21(e) of the

Outer Continental Shelf Lands Act Amendments of 1978. In 1996, NURP undertook a reinvention that more closely focused its research directions on NOAA's management responsibilities and provided more autonomy to the centers to deliver research capabilities consistent with regional perspectives and their university systems. More recently, NURP has been working with the new Office of Ocean Exploration to develop collaborative efforts in support of an expanded program in exploration.

Financial Profile (IN THOUSANDS OF DOLLARDS)

Fiscal Year	Permanent Funding	Other NOAA	Non-NOAA	Pass Through	TOTAL
FY 2001	13691.3	2000	0	0	15691
FY 2002	13800	5000	500	0	19300
FY 2003	13680	3122	0	0	16802

Personnel Data

FY	FEDERAL EMPLOYEES	JOINT INSTITUTE	Contractors	TOTAL
FY1999	6	0	0	6
FY 2000	5	0	0	5
FY 2001	5	0	0	5
FY 2002	5	0	0	5
FY 2003	5	0	1	6

Average Age Federal/Scientific/Engineering and Technical Staff 60
Average Age of JI/Scientific/Engineering and Technical Staff None

Federal Staff PhD 25% MS 50%

NOAA'S UNDERSEA RESEARCH PROGRAM PARTNERSHIPS

PARTNERSHIPS	IDENTIFY (and explain)
JOINT INSTITUTES	
PARTNERSHIPS WITH OAR LABS	**AOML, PMEL, GLERL**
OTHER OAR PROGRAMS	**Sea Grant**
OTHER NOAA RELATIONSHIPS	**NMFS, Marine Sanctuaries/Reserves,OE**
OTHER FEDERAL AGENCIES	**US Navy, USGS, MMS, NSF, NASA**
STATE AGENCIES	
LOCAL PARTNERSHIPS	
UNIVERSITY PARTNERSHIPS	**6 NURP Centers and NIUST**
INTERNATIONAL	**Japan, France**

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Accomplishments

List 3-5 major accomplishments for your program. If accomplishment occurred more than 2 years ago, cite recent progress. Please specify importance of accomplishment, who have been the major users and what has been the benefit to the taxpayer.

The following are examples of scientific findings important to the understanding required for NOAA's resource management responsibilities.

Coral Reef Ecosystems depend on deep-water upwelling:
Upwelling caused by internal tides brings nutrients up from the deep sea to Florida coral reefs several times a day, causing nitrogen and phosphorus levels on the outer coral reef to increase by 10 to 100 times over background levels. These levels are 20-40 times more nutrients than input from sewage and storm water runoff. This study utilized saturation diving and the NOAA Aquarius underwater laboratory in Key Largo. "The presence of this water on the reef for extended periods of time has the potential to significantly affect the biology of corals, sponges, and algae" (James Leichter)

Community Succession and Decomposition at Deep-sea Nutrient sources:
Whale carcasses, wood, and kelp that fall to the seafloor provide a sudden, concentrated food source for organisms in the deep sea. Such foodfalls support a succession of marine biological communities for up to a century, raising questions about the impact of 19th century whaling on deep-sea biota. Some still-decomposing whale skeletons have been aged to over 80 years. The specialized biological communities at foodfalls have little overlap with those at cold-seeps or thermal vents, but may exchange species with them over evolutionary time.

Long-term Continuous Phytoplankton Monitoring
Scientists have tested the first in-situ robotic sampler for continuous study of marine phytoplankton. The FlowCytobot, attached to the long-term environmental observatory (LEO-15) near the Rutgers Marine Lab, automatically measures chlorophyll fluorescence at 5 meters depth every 5 minutes for weeks at a time. It can be controlled and observed using the internet. Such instruments can help monitor for toxic phytoplankton blooms and effects of coastal runoff or pollution, producing high-resolution, continuous measurements over long time periods. It will help develop models of phytoplankton responses to environmental change or disturbance.

Bottom fishing has little impact on corals at some Hawaiian reefs -
Scientists studied the impacts of bottom-fishing on coral reefs in the Northwest Hawaiian Islands. During a two-week cruise with the submersible PISCES V, they observed large numbers of fish, and low densities of deepwater coral, suggesting that low-intensity fishing has had little impact on coral communities. However, they also discovered that endangered monk seals dive specifically onto deep-water coral banks where certain fish species aggregate. An

unresolved question is whether fish are attracted by the coral, or by the topography of steep walls and overhangs. As a result of this finding, permits for harvesting these deep corals, were refused.

And Coral harvesting has little impact on fish at others –
Submersible dives between Maui and Lanai show that harvesters have selectively removed the largest black coral colonies from the population, causing a shift toward smaller colonies and reduced recruitment. Numerous fish species use the coral for temporary shelter, but also occur in habitats where black coral is absent. Researchers concluded that harvesting black coral in these areas is unlikely to have a significant impact on bottomfish species.

Spawning Aggregations make fish vulnerable to over fishing:
Nassau grouper have been reduced throughout the Caribbean Sea and Gulf of Mexico by over fishing, and may take decades to recover. NURP funded researchers found that Nassau grouper form large spawning aggregations each year during winter full moons, increasing their vulnerability to over fishing. Fish may migrate over 100 miles to spawning aggregations, and may spend only a few days there. Long term studies show reductions in fish size and altered male:female ratios. This research will contribute to the rebuilding of Nassau grouper stocks and help support sustainable fisheries.

NURP Supports Gas Hydrate Research:
Gas hydrates are crystalline lattices of methane and water that remain frozen under deep-sea conditions. They are important features because they may hold more than twice the carbon of known fossil carbon reserves, contribute to global warming as they melt, support complex communities of deep-sea organisms, and may cause instability of ocean floor sediments and slopes. They also harbor extremophile bacteria that may have potential applications in human medicine and technology. NURP funded studies have focused on studying rates of methane outgassing and on the unique ecosystems found living around methane seep sites.